SLOVENSKI STANDARD
SIST EN 13757-5:2016

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Komunikacijski sistemi za merilnike - 5. del: Brezžično odčitavanje M-Bus

Communication systems for meters - Part 5: Wireless M-Bus relaying

Kommunikationssysteme für Zähler - Teil 5: Weitervermittlung für den drahtlosen M-Bus

Systèmes de communication pour compteurs - Partie 5: Relais de transmission sans fil M-Bus

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EUROPEAN STANDARD

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English Version

Communication systems for meters - Part 5: Wireless M-Bus relaying

Systèmes de communication - Partie 5: Relais de transmission sans fil M-Bus

Kommunikationssysteme für Zähler - Teil 5: Weitervermittlung

This European Standard was approved by CEN on 22 August 2015.

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European foreword

This document (EN 13757-5:2015) has been prepared by Technical Committee CEN/TC 294 “Communication systems for meters”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13757-5:2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

EN 13757 comprises the following parts:

— *Part 1: Data exchange*

— *Part 2: Physical and link layer*

— *Part 3: Dedicated application layer*

— *Part 4: Wireless meter readout (Radio meter reading for operation in SRD bands)*

— *Part 5: Wireless M-Bus relaying*

— *Part 6: Local Bus*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the protocols to use when performing relaying in wireless meter readout networks. This European Standard is an extension to wireless meter readout specified in EN 13757-4. It supports the routing of modes P and Q, and simple single-hop repeating of modes S, T, C, F and N.

The main use of this European Standard is to support simple retransmission as well as routed wireless networks for the readout of meters.

NOTE Electricity meters are not covered by this standard, as the standardization of remote readout of electricity meters is a task for IEC/CENELEC.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13757-1:2014, *Communication systems for meters — Part 1: Data exchange*

EN 13757-3:2013, *Communication systems for meters and remote reading of meters — Part 3: Dedicated application layer*

EN 13757-4:2013, *Communication systems for meters and remote reading of meters — Part 4: Wireless meter readout (Radio meter reading for operation in SRD bands)*

EN 60870-5-1:1993, *Telecontrol equipment and systems — Part 5: Transmission protocols — Section 1: Transmission frame formats (IEC 60870-5-1:1990)*

EN 60870-5-2:1993, *Telecontrol equipment and systems — Part 5: Transmission protocols — Section 2: Link transmission procedures (IEC 60870-5-2:1992)*

EN 62054-21:2004, *Electricity metering (a.c.) — Tariff and load control — Part 21: Particular requirements for time switches (EN 62054-21:2002)*

RFC 1662 July 1994, *HDLC-like Framing, Appendix C. Fast Frame Check Sequence (FCS) Implementation*

ETSI EN 300 220-1:2012, *Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW; Part 1: Technical characteristics and test methods*

CEPT/ERC/REC 70-03, *Relating to the use of short range devices (SRD)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
Bidirectional Single Hop Repeater
BSHR
repeater retransmitting original frames in upstream as well as downstream direction

Note 1 to entry: The 'H' bit in the Extended Link Layer shows whether or not frames are original or repeated.

3.2
block
sub-element of a frame

Note 1 to entry: For an EN 60870-5-1 based protocol; this will be up to 16 bytes of user data completed by a CRC check.

3.3
downlink
transmission in downstream direction

3.4
downstream
transmission of data in the direction from the Data Collecting Unit to the Meter

3.5
end node
Meter or Data Collecting Unit

Note 1 to entry: The Data Collecting Unit is named Other Device in EN 13757-4.

3.6
frame
set of data encapsulated by a header and optionally a trailer

Note 1 to entry: For an EN 60870-5-1 based protocol this will be a start character followed by up to 16 blocks of data.

3.7
gateway
intermediate node in a data communications network, connected to two or more logical networks, where the protocols or modes used on the logical networks are different

3.8
hop
transfer of a set of data from one node to an adjacent node, as one of the steps in the transfer of data between end nodes

3.9
intermediate node
node in a network sitting in-between a Data Collecting Unit and a Meter

3.10
meter assignment
exclusively pairing a Meter to a repeater

Note 1 to entry: This is performed by Network Control. This allows access and downstream communication to the meter.

3.11
meter registration
registration of a meter in one or several repeaters

Note 1 to entry: This allows the repeater to repeat the transmissions from the Meter upstream.

3.12
Network control
NC
logical unit to control and supervise repeaters in the network

Note 1 to entry: Network Control may be located in a Data Collecting Unit, in a repeater or in a dedicated device outside the network.

3.13
node
unit in a network that is able to send and receive data

3.14
Other Device
Data Collecting Unit

Note 1 to entry: This is the term used in EN 13757-4.

3.15
primary station
network node that controls all of the data exchange in a simple network with one central node, unbalanced data transfer and multiple remote nodes

Note 1 to entry: All data transfer will (normally) be controlled by the primary station. A Data Collecting Unit will be a primary station.

3.16
radio scan list
list of all Meters having sent a valid frame

Note 1 to entry: Entries in this list will be removed after a certain time (time out).

3.17
relaying
forwarding of information from one logical network to another

3.18
repeat meter list
RML
list of end nodes registered for repetition

Note 1 to entry: The list is allocated to (and downloaded into) a repeater by Network Control. The list is generated from meter assignment and meter registration.

3.19
repeater
intermediate node in a data communications network, retransmitting data without modifying address information

3.20
router
intermediate node in a data communications network, connected to two or more logical networks with identical protocols and modes

3.21
secondary station
node in a hierarchical network, that is able to receive commands and requests from a central node, the primary station, and to send a response back to the central node

Note 1 to entry: A Meter will be a secondary station.

3.22
Uni-directional single hop repeater
USHR
repeater retransmitting original frames in upstream direction only

Note 1 to entry: The 'H' bit in the Extended Link Layer shows whether or not frames are original or repeated.

3.23
uplink
transmission in upstream direction

3.24
upstream
transmission of data in the direction from the Meter to the Data Collecting Unit

4 Symbols

The following symbols are used for timing parameters on drawings in Annex A.

t_{DRFS}	Time delay repeater, fixed, start of message reference
t_{DRFE}	Time delay repeater, fixed, end of message reference
$t_{DRSlotN}$	Time delay repeater, where N may be 1 to 7
t_{DRR}	Time delay repeater, randomized
t_{IA}	Time delay Installation Announcement
t_{RO}	Time for response from Other Device (default, fast)
t_{RO_slow}	Time for response from Other Device(slow)
t_{RR}	Time for response from repeater (default, fast)
t_{RR_slow}	Time for response from repeater (slow)
t_{TxD}	Time delay for transmission in Frequent Access Cycle (FAC)

5 Introduction

5.1 General

This clause is an explanatory clause, and the specific requirements are to be found in the latter clauses of this European Standard.

5.2 Use of retransmission

The availability of low cost radio modules has made it feasible to use radio communication for the readout of meter data. Many meters are battery operated and have a very strict power budget and regulatory requirements are imposed as well. This limits the transmitting power levels and thereby the useful distance between transmitters and receivers. The use of reinforced concrete, conductive surface coatings and placement of meters below ground level like in pits and in the basement of the buildings

aggravates the problem of directly communicating between a data collecting unit and a meter. This limits the useful size of radio networks unless forwarding is used. By letting some of the nodes forward, the effective size of the network can be increased. This makes radio based networks a more cost effective solution.

A forwarding concept will still have a number of constraints. The cost of adding this capability to the meters has to be low, since meters are cost sensitive high volume products. The limited energy and computing power available in the individual nodes mandates a limited complexity of the software handling the communications protocol and the forwarding.

Operating and installation costs are important factors when planning for meter networks. The reconfiguration of the network when adding, replacing or removing meters may be automated to limit the operating cost.

The overhead due to forwarding of data transmitted is required to be low to keep the transmission duty cycle within the limitations imposed by the authorities.

The fact that meters are cost sensitive devices makes it advantageous to allow for simple single-hop retransmission (repeating) as well. This transmission works mainly at the Physical Layer level. Such repeaters have a limited functionality but cover the needs for low cost meters. The architecture of such repeaters is described in the subclause below and is specified in detail in Clause 9.

5.3 Repeating

If a direct transmission between a Meter and an Other Device is not possible a repeater may be used in between. Such a repeater shall be able to work without complex installation procedures and without routing capability. The single hop repeater shall support one-way or two-way communication.

NOTE A repeater according to this European Standard is only able to forward the message for a single hop.

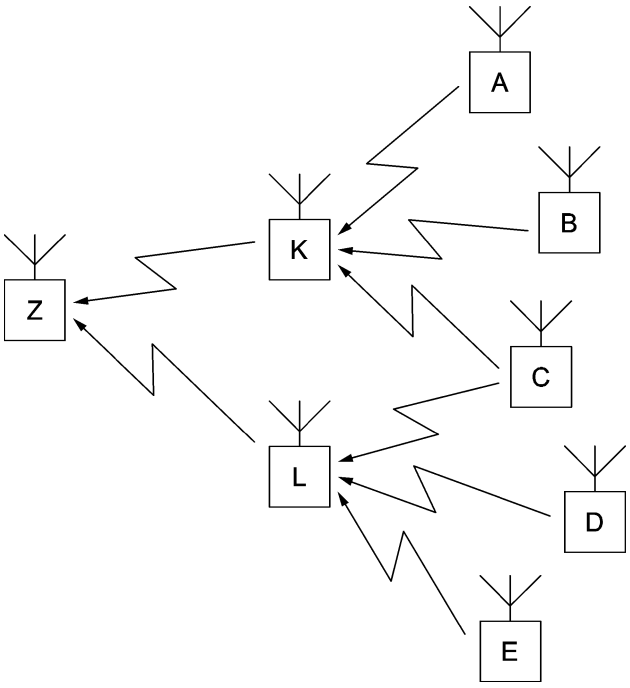
— Unidirectional Single Hop Repeater (USHR) only repeating messages from the Meter upstream to the Other Device.

— Bidirectional Single Hop Repeater (BSHR) repeating messages in both directions, i.e. from the Meter upstream to the Other Device and from the Other Device downstream to the addressed Meter.

A repeater may, at the same time, operate as an USHR for some meters and as a BSHR for other meters.

The network architecture is shown on Figure 1. The Meters A, B, C, D, and E, are not always able to reach the Other Device Z directly. Two repeaters, K and L, are inserted to handle this. Meters A, B, C are able to reach repeater K that will forward the frames to the Other Device Z. Meters C, D and E are able to reach repeater L that will forward their frames to the Other Device Z. Repeater K may as well be able to receive the data from repeater L but it will not repeat the frames once more, as a 'repeated flag' is already set in the frame.

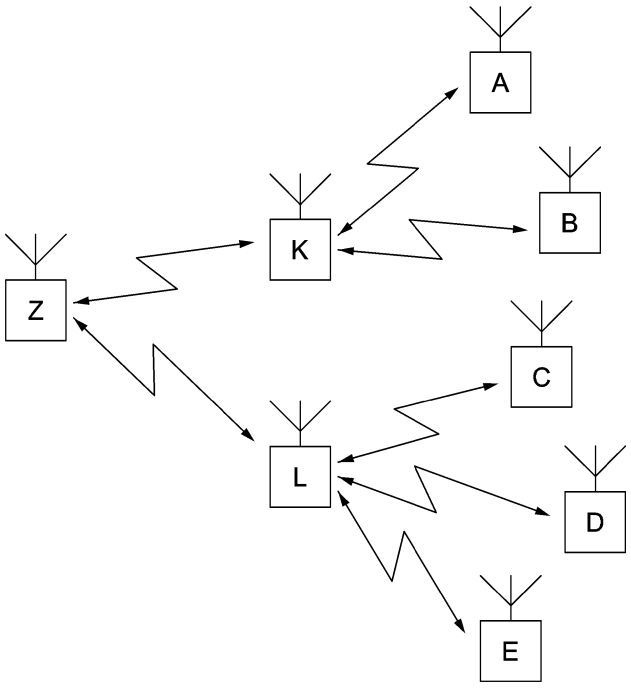
Meter C is able to reach both repeaters. This can generate duplication and collisions. A randomized timing in the individual repeaters ensures that the frame from a meter will not collide frequently if it is repeated by multiple unidirectional single hop repeaters.



Key

A – E meters
K – L repeater
Z Other Device

Figure 1 — Unidirectional Single Hop Repeater, USHR



Key

A – E meters
K – L repeater
Z Other Device

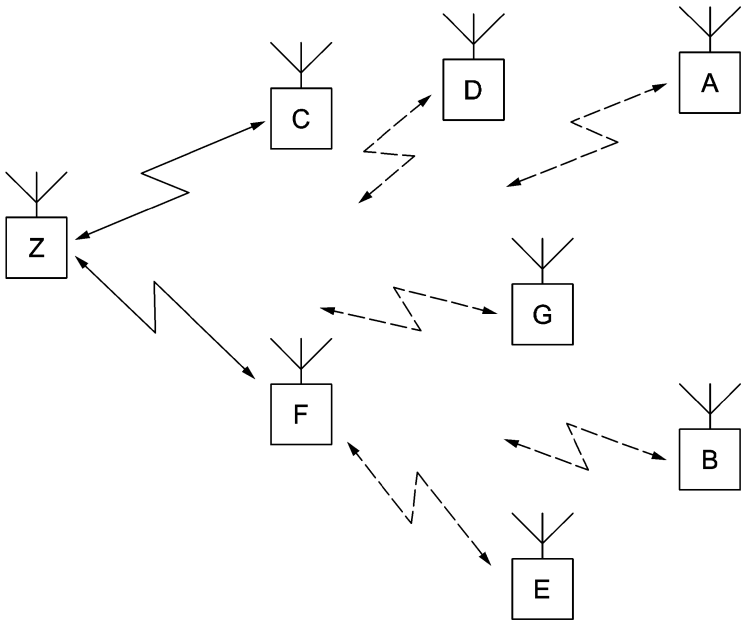
Figure 2 — Bidirectional Single Hop Repeater, BSHR

Bi-direction repetition, as shown on Figure 2, may get a little more complex once bidirectional meters and repeaters are used. The bidirectional meters may, for energy saving purpose, only enable its receiver in a narrow listening window. The setup in the repeater ensures that any response from the Other Device is transmitted in this listening window. The details of this are specified in Clause 9.

5.4 Relaying

5.4.1 Overview

A radio network may have a structure like the one shown in Figure 3 below. The Nodes A, B, C, D, E, F and G are simple meters. They all need to communicate with Node Z, the data collecting unit / the primary station. In the current setup only the Nodes C and F, are able to reach the Node Z. The other nodes cannot reach the Node Z. The useful size of this network is thereby limited to only 2 nodes, Nodes C and F.



Key

A – G simple meters

Z data collecting unit/primary station

Figure 3 — Network with simple nodes, without relaying

Extending the network by adding some nodes with relaying capability will give a structure as shown on Figure 4. Nodes F and G have now been extended to include relaying capability. Communication between Nodes A, B and D and the primary station is achieved by relaying the data through Nodes G and F. Node A sends data to node G, node G relays data to node F and node F relays data to the Node Z, the data collecting unit. The size of the network can now be extended to include all of the nodes shown. The Nodes F and G may be dedicated relaying nodes or meters with extended capabilities. Transmission from one node to another is called a hop. The transmission from node A to the data collecting unit/primary station consists of three hops.